Achromatic Vector Vortex Waveplates for Coronagraphy, Phase II

Completed Technology Project (2012 - 2014)

Project Introduction

Using small aperture telescopes for detecting exoplanets could have a significant impact on astronomy and other imaging and space communication systems. In this new generation of smaller, lighter and more affordable coronagraph systems, the starlight is rejected with the aid of phase-based transparent masks capable of transmitting planetary light at small angular separation from the star. These so-called vector vortex waveplates (VVW) are complex optical components wherein the optical axis orientation is azimuthally modulated in space at a high spatial frequency. In the Phase 1 of the project, we showed the feasibility of fabricating VVWs that would meet requirements for astronomy applications due to small singularity size, high topological charge, high contrast, and broadband functionality. The breakthrough polarization conversion and beam shaping technology of printing VVWs developed in the Phase 1 will undergo further fundamental improvements in the Phase 2 of the project along with further optimization of photoalignment materials and liquid crystal polymers to fabricate and deliver VVWs characterized by: subwavelength singularity sizes; spectrally broadband/achromatic functionality, particularly, for infrared wavelengths; stability to radiation and large temperature variations; and functionality at cryogenic temperatures. This will accomplish the project's general objective – development and delivery of VVWs adequate for practical use.

Primary U.S. Work Locations and Key Partners

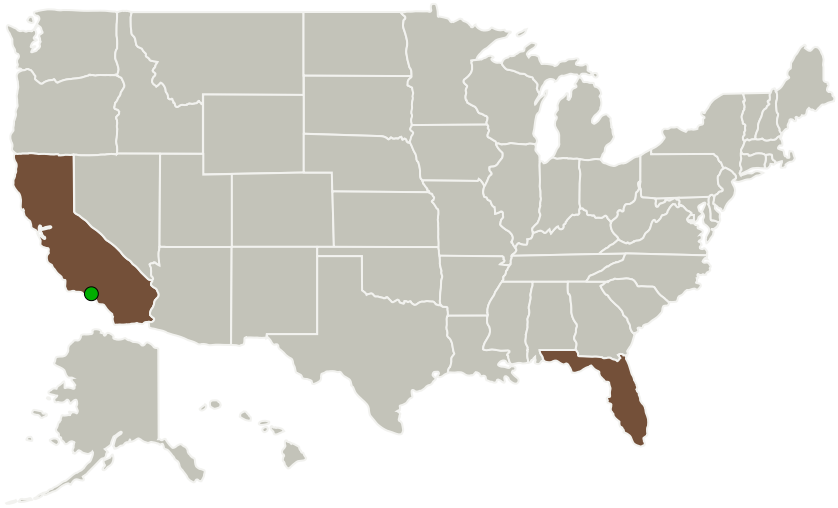


Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

BeamCo

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Continued on following page.

Achromatic Vector Vortex Waveplates for Coronagraphy, Phase II

Completed Technology Project (2012 - 2014)

Organizations Performing Work	Role	Type	Location
BeamCo	Lead Organization	Industry Women-Owned Small Business (WOSB)	
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Florida

Project Transitions

April 2012: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137371)*

Images

Project Image
Achromatic Vector Vortex Waveplates for Coronagraphy Project Image
(https://techport.nasa.gov/image/126162)

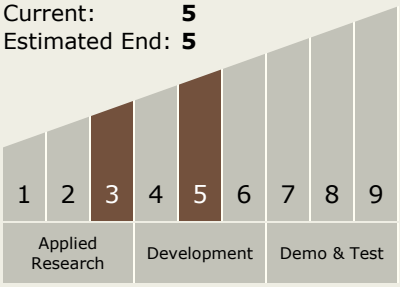
Project Management *(cont.)*

Principal Investigator:
Nelson Tabirian

Co-Investigator:
Nelson Tabirian

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System